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(71) Applicant: Al'tshuler Grigorij Borisovich Erofeev Andrej Viktorovich

(72) Inventor: Al'tshuler Grigorij Borisovich, Erofeev Andrej Viktorovich,

(73) Proprietor: Al'tshuler Grigorij Borisovich Erofeev Andrej Viktorovich

(54) METHOD OF TREATMENT OF TOOTH HARD TISSUES BY LASER RADIATION AND DEVICE FOR ITS REALIZATION

(57) Abstract:

FIELD: medical equipment, applicable in stomatology at treatment of caries and dental prosthetics. SUBSTANCE: the method consists in action of laser pulse on the tooth tissue, pulse intensity of light radiation of tissue treatment products is detected, and the type of tissue to be treated is determined according to the pulse peak amplitude. The device uses a pulsed laser and means for delivery and focusing of laser radiation arranged in succession in the optical axis, photodetector whose input is optically integrated with the focusing system focal plane, and an electric pulse amplitude meter, whose input is electrically coupled to the photodetector output, and the output is electrically coupled to the display unit input; the photodetector is installed in such a manner that the direction of its maximum sensitivity makes up angle α with the direction of the optical axis at the output of the focusing system: this angle satisfies condition $\alpha > \arctg(D/2f)$, where D - clear aperture of the focusing system output window, and f - its focal length. EFFECT: reduced danger of laser injury to patient. 6 cl, 5 dwg6

Y1306pe reHHe OTHOCHTICA K Mc,E(HHHHCKOfTeXHHKe H MoJKeT 6bITb LICHOnb30BaHO B CTOMATOJIOPIHH npH ne^{1e}HHH Kapyeca H npOTe3HpOBaHHH 3y6OB. OCHOBBHIM HejIOCTaTKOM H3BeCTHbIX cHoco6OB o6pa6OTKH TBepHbIX TKaHei 3y6a na3epHIM H3Jy^{1e}HHeM H yCTpoficTB, pearHMyIOy Mx 3TH Cn0006bI, HBJIAETCA BbICOKaB oHacHocTb HaHeCeHHa na3epxo2 TpaBMbI nau,HeHTy. 3aayefi, Ha pelleHHe KOTOpOI HanpaBneHO oasBJineMoe H3o6pCTeHHe, HByeTCA CHYKеHHc oHacHOCTH HaHeCeHHa nAHCHTY na3epaof TpaBMbI 3a c^{1e}Tb o6eche^{1e}HHH B03MOIKHOCTH onreHeHHH THHa o6paMmaMoI TKaHH. YKa3aHHa5 3aJZaua, r ocTpaeTcH TeM, uTO B cHoco6e o6pa6OTKH TBepijbix TKaHeij 3y6a na3epHbIM H3ny^{1e}HeHieM, BKJinouaIOy eM Bo3Jefic^{1b}He Ha TKaHH 3y6a na3epHopo HMmpH,ca, perCTpHpyIOT HHTeHCHBHOCTb HMnHbCa CBeTOBOPO H3ny^{1e}HHH npOHKTOB O6pa6OTKH TKaHH, HO HHKOBOMy 3Ha^{1e}HHIO KOTOpOPO onpejennOT THH o6pa6aTbBaEMOf TKaHH. YKa3aHHaI 3a);aJIa TaKKe JTOCTHpaeTcH TeM, uTO yCTPOICTBO ;vIM o6pa6OTKH TBepijbIX TKaHeij 3y6a na3epHbIM H3ny^{1e}HeHieM, COCTOaIJee H3 HOIJJe oBaTenbHO paCHOJIOKeHHbIX BHOHb OHTH^{1e}CKOII **oCH** HMJHbHbCOBO na3epa, a TaKKe cpeCTBa JIOCTaBK H)OKYCHPOBK H **na3epllopo** H3ny^{1e}HHa, COHep;KHT **npOTOnpHeMHKK**, BXOJ KOTOpO OHTH^{1e}CKH COHPIKCH c 40KanbHOLI 1HOCKOCTbIO 4 oKycMpyIOy efI CHCTeMbI, H H3MepHTCb aMnITyTbI 9nCKTpH¹CKKHx HMpHbHCOB, BXOJ~ KOTOpOPO 3HeKTpH^{1e}CKH COHpaHCH c BbIXOM TPOTOnpJIeMIIHKa, a BbIXOJ; 3HeKTpH¹CKKH conp5 Kell co BXOHOM yCTPOICTBa HH) HKAHHH, JIp¹JIeM (**npOTOnpHeMHKK** yCTaHOBneH TaKHM O6pa3OM, JITO HanpaBneHHe ero MaKCHManbHOi TyCTBHTCbHIOCTH COCTaBpeT c HanpaBneHHeM OHTH^{1e}CKOfi ocn Ha BbIXOie 4oxycHpyIOyefi eneTeHpbIaHia4a, yIOBneTBopHIOH3H yCBOHIO a >arct(D/2f), rJie D - cHCTO3of jHMaCTp bXOHIOPO Dada (poxycpJyIOJJIefI cHCTeMbI, a f - ee (4OKYCHOC pacCToAHHe. 2 c. ii 4 3.n.t., 5 rm.

Description [Onmcarne H3o6peTeHHsi]:

L13o6peTeHae OTHOCNTCA K McJ uU1HCKOLI TeXHHKe H MOZKCT 6b1Tb HCHOnb3OBaHO B CTOMaTOJIOpM.

1/b3BeceH cnoco6 yjjaneHNA HauanbHbIX KapBO3Hb1X nOBpe?Iq eHn 1 H/Hnn KaMHC 1 3y6a (naTeHT USA 4521194, A 61 C 05/00, npHopBTET 22.12.83), BKrloulalonin o6pa6oTKy TBCp) bIX TKaHCL 3y6a HMNynbCHbIM na3CpHbIM Li3JlyeHHeM. OCHOBBIM Her OCTaTKOM jjaHHOpO cnoco6a ABnHeTCA BbICOKa\$ OnaCHOCTb HaxeceHHA na3epxog TpaBMbl npH o6pa6oTKe TBepjibIX TKaHe» 3y6a.

HaM6onee 6nN3KHM no TexHHUecxoil cynioCTH # ПpHHATbIM 3a npOTOTH ABNACTCA cnoco6 neuenns **HeOCTOKHeHHOpO** KapHeca (a.c.CCCP N 1593669, A 61 C 5/00, npHopwreT 14.11.85, ony6n. 23.09.90 BUI N 35). BKnloulaloluxil o6pa6oTKy TBepjiblx TKaxe 1 3y6a na3epHbIM H3JIMMeliNeM c **jjHHOI4 BonHbl** 2,94 MKM, j[naTenbHOCTbIO NMIIynCOB 100 500 MKC, **MOHJOCTI,10 .0,5 1,0 Z(7K/HMn, IIJIOHOCTbIO MOIAHOCTH** $2 \cdot 10^4 + 3 \cdot 10$ BT/CM2, ²**laCTOTOLI 1 TLL. 3KC1103anx4e2 3-30 c. OCHOBBIM HegOCTaTKOM npOTOTHna** HBIACTCA onacHocrb **HaneCeHHH na3epHOI** TpaBMbl npH o6pa6oTKe TKaHeii 3y6a, **CB013anHaa C** OTCyTCTBHeM B npOTOTHTC npouejpbi onpejjeneHNA Tana o6pa6aTbIBaeMOLI TKaHH.

IR3BeCTHO yCTPOLICTBO jinn o6pa6oTKH TBepjibIX TKaHevl 3y6a **na3epHbIM** 143nyIeIneM (naTeHT WO 89/08432, A 61 C 5/00, npHopHTeT 10.03.89), **BKnloulalonjee nocneJoBaTenbno pacnono}KeHbie BJ[Onb OHTHlleCKO\$ OCN HMnynbCHbl\$ na3ep H CpejicTBO jjocTaBKN** 1437ly⁴ICHN1 K 3y6y B BNjic ofTHUeCKOpO BonoKHa. OCHOBBIM HCjJOCTaTKOM jjaHHOpO yCTPOLICTBa ABnIeTCA BbICOKaH OnaCHOCTb HaHeCeHHA na3CPHO171 TpaBMbl npH o6pa6oTKe TBepj;blX TKaneli 3y6a.

HaH6onee 6nH3KHM no TexHHUecxoil CyWjIOCTH H npHHATbIM 3a npOTOTH HBJICaTCA yCTPOICTBO jinn o6pa6oTKH TBepj;IX TKaHe}I 3y6a na3epHbIM **H3JlyerneM** (naTeHT WO 90/01907, A 61 C 5/00, npnopHTeT 25.08.89), cojje7Kanje nocnejjosaTenbHo pacnono KeHHble BjjOnb onTHUeCKO2I oca **aMIIynbCHblyI** na3ep, a TaK,Ke cpej;CTBO j;ocTaBKH 14 4OKYCnpOBK14 na3epxop LI3ny4eHa5, HKJIOUa!Onjee OTpe3OK onTN⁴leCKOpO HOJIOKHa, BXOJ KOTOpOpO onTlyecKa conpSijKeH c BbIxojOM na3epa, N (pOKycapylolljero CaCTeMy, BXOjj KOTOpOYI OHTIMECKH ConpM7KeH c BbIXOjjOM OHTN⁴leCKOpO BOnOKHa, a BbIXOjj AHnHCTCH BbIXOjjOM yCTPOLICTBa. OCHOBBIM HegOCTaTKOM npOTOTana ABnBeTCH OnaCHOCTb HaHeCeHHA na3epHON TpaBMbl npH o6pa6oTKe TKaHet 3y6a, CBA3aHHas c OTCyTCTBHeM B npOTOTHne CNCTeMbi onpejjeneHnn Tana o6pa6aTbIBaeMOLI TKaHN.

3ajjauei4, Ha peuteHne KOTOpOI4 Hanpanнено 3a IBnxemoe N3o6peTeHne, CIBneTCH CHLUKenne OnaCHOCTLI HaHeceHas nan, MenTy na3epnoLI TpaBMbl 3a cueT o6eue ⁴TeHaH B03MO2KHOCTh onnc enelins Tana o6pa6aTbIBaeMOLI TKaHN.

YKa3aHHaH 3ajja⁴ia jjocTNraeTcH TCM, ⁴ITO B cnoco6e o6pa6oTKH TBCpjjbIX TKaneli 3y6a na3epHbIM H3nyeHHeM, BKnlolalonjeM B03jjeLICTBHe Ha TKaHN 3y6a na3epnop aMnynbca, peraCTpapyloT 14HTeHCNBHOCTb NMIIynbca **CHTOBOpO** IIIJlyeHNA **npOjyKTOB** o6pa6oTKH TKaHN, no naKOBOMy 3Ha⁴TeHpo KOTOpOYI onpejjen5loT TIM **o6pa6aTbIBaeMOLI** TKaHN. Ans IOBbIIIJCHH jjoCTOBepHOCTH onpejjeneHas Tana o6pa6aTbIBaeMoi TKaHN HHTeHCHBHOCcb **yKa3aHHOpO CHETOBOPO 1/13nyeHHA** perNCTpmpylOT **B CnCKTpaJIBHOM** jjaana30He **350** 500 HM. C ToI4 7Ke Ijellbio o) **HOBpeMeHHO** c peracTpaijMei NHTCHCNBHOCTH HMTIynCa **CBCTOBOpO H3ny⁴TeHNA** n3Mep5noT **BpeMeHHylo** 3ajje7KKy Me}Kjj}* na3epHbIM N **CBETOBBIM** Tdl nlynCaMLI, no BCTINUNHe KOTOpOIl yTO⁴nimIOT TIM o6pa6aTbIBaeMOLI TKaHI4.

YKa3aHHas 3ajja'ia TaK7Ke jjocTHraeTcs -rem, uTO yCTpoiCTBO jina o6pa6oTKH TBepjiblx TKaHei 3y6a na3epHbIM H3Jly⁴TeHHeM, cocTosjee 143 nocnejjosaTenbno pacnono7KeHHbIx BjjOnb onTN⁴leCKOI/ OCN HMnynbCHOpO na3epa, a TaK7Ke cpejicTba J(OCTaBKN H 4)OKYCHpOBKN na3epHOp 113ny⁴TeHnH, COjje7KNT (**noTonpHeMHKK**, BXOjj KOTOpOpO onTN⁴leCKN ConpHvKeH C Y4OKanbHOI4 mOCKOCTbIO 4oxycilpylolgefI CNCTeMbl, **H** 143MepNTenb aMHnHTyjjbl 3neKTpN⁴leCKNX LIMIIynCOB, BXOjj KOTOpOpO 311eKTpH⁴CKKN ConpH7KeH c BbIXOjjOM ItoTonpHeMHKa, a BbIXOjj 3neKTpN⁴leCKN 00npSIKCH co BXO OM yCTPOLICTBa aHjjIKaUMH,

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 \$ EHMOUGH O,I0313ahm.L110 x0_gad.LO a14HHaxc0IroloHd OH^EUa.LEHOtlaauo Nmunrxcdalloa 'Z AgA_g
 x Eda_gEU LO KHHahAUCH mlaB.Laotl NIoa.Iatlada o3 uaacaduo3 mxoahm.LUO o.Iodo.Lox t1oxi a
 'j dacul graxogIIAurw (g -amp z 3) ,Lmxcdatloa oa.L3Hod.L3A Ismua.Ladgo_gm I4udildo(2 f, •u oLj

'HoxaoxmdLln:
 EHECEAOU OHHOU3A g 'I.HId EH ExmHYIYamduo.Lo4 IILL30HHauaEduEH EWNIEd.IEHt[
 •HbEtiff_g io zaumad KHHaaalLLaott Nramaou3A IAI19PIHt(Oxg03H K3,LaRUH15 'aHHuo,L33ed
 aoHaAxo4 as ; E 'i^Ewaa,3ma Hallo1AdmaAxd2 EHHO o,I0Ht(0XI4a d,LaNlemtf Hoao.Laa3 Q
 atf.I 'QZ/a) aIE < E oaiouaA gm2nounsdoA,Lauaot(A E uo,IA x'm oaoaa v_Iatno1AdmaAxo4 atfoxi4a
 EH moo I30313ahH,L110 NlaHHaUHEdIEH 3 ,WISUHE,L303 H,Looh4Lra.LHa,Laa/Ch HOH^ELEI113MENI
 O.Ia aMHauauduaH :otmaouaA aztnoiadao.LaraotfA E uo.LC 14vta.Lazo HatuoAdaaAxo4 o foxi4a
 EH H30 HO5133hH.L110 PZOIIIHauaEdiIEH a .L3alfAE L30a IILL30H4Ua.LHa.LOHah HOH4uENIm3MENI
 Oda OHHalraadUIBH O.Lh 'P10CEd90 IIHME.L HI4HHaLIUGHE.L3S 'xaHRIamduO.L04 oaaomaxcdatfoa
 'Ea,Iaaods,oA Kmt ada,mox mmHaLadgo_gm NIa71IKoaaaH a KELRaEuaitladu 'NIo_gEdgo WmxBJ,

'NIarIHaHAI_gH NII4Hda_gEU 3
 HHa taHatforlaEea adu EuaxE4 o.IOHHoncode Hd,LAHa a,aWxmu_goa aodo.Lox 'HHEM,L mx.Lo9Ed90
 ao.LxAtfodu amuahAU_gH aoao,Laa3 ,LaEtfbU0U aH MHHNIaHduO.LO(4 EH ,io.Le adLj •amHKO.taaad
 aoHaAxo4 as , a °I4vpaa.3ma gahtIolcdH31(xo4 auxo oJoHtloxI4a d t.aNrawtf HoaaLaa a
 al:fa 'Og/Q)ADia < E oaiouaA HviluousoA.LauaotfA^A uo.iA I4i'4aLaaa HatnofAdmaAxo4 atfoxi a
 EH H30 IOx3ahH.LIIO I~rOHHauaEdiIEH a ,LaKUaE,LOOa E3lunnamduo,Lo4) ILL30H^EIraLma,L3aAh
 gOHgtfPZH3aapI aanatraaduaz Hu3a aanAuo nos, a 4,LHHuor^Pia OHxrovz amaoU.I3A
 33Hftau3011 •N O3 hAII Nli^Eitda_gEu a d a,L3HatfoNraaea m'edoa,ox 'muaxE4 o,I0HHOH_gOde H.L3Eh
 HO L ISHHahAII_gH QIOaO,Laaa BHHPZOHDUO.L04) EH KHHEdEUOU 4.LH,L3A1.101f aH H OH '(14Y4a.L3m3
 gaIIIOAdm3Ax0(b 4,L3Ox3ouu lsanquexo) HHEB,L ummanAugo HOHO_g a EMHHNramduaLO4
 aHHaECKduO3 aOxaah LUO q.LHhau0390 ox4UoSL aH ONUIIt(0X90OH '(HH,LHaf '4IENIe)
 aIHH,L as 90 oIIIIWIdO40HH O,IatIIA3aH 'IHEM.L Hx,LO9'ed90 ao,LxArtodu KHHahAuCH O.IOaO,I.aaa
 HIIIIEd taH.Iad Hirt ofh 'OHEcExou awado.Lad -Necadgo Nu4NIa&dauod,LHOxah KaLolanapI_ga
 HHEM,L Hx,LOgudgo ao,LiAtfodu lsnnahAuem o oao,Laaa d,Lxaua H 'LL30Ham3HO.LHH
 uma laHalomHEea oJoxa,L aLa,L4u Cead •i'Nrouaxa4 NIIHHHoafode a KaLaexaaadau
 xohAu LH4ndacair atlt 'xKJaeugO xa.L a as ax a m on '(1gr1aLom3 HalnolAdaaAxo4 m.LOOx3oIIU
 HOH9Irexo4l a) H)Logedgo mac a ox^uuo,L aH PlaIHahAUCH NII4Hdacau a LOIAHtaHatfovVHE_gs
 HHEM.L Ha,LOgEd90 I4,LxAtfodu NraHHahAlrem Nu nda_gEu 4HEX.L oiANraaa14,LEGad90

uyBCTBHTCnbHOCTM **coctHri** HeT C HanpaBTleHMeM onTII^ЕleCKOLi **oCK** Ha BbIXOge 4OKycmpylonjeLi cLcreMbI yron 28°. BbIXofj 4oTollpleMBLtKa 9neKTpHuecKM COHnHAieH 9epe3 M3MepHTCnb aMnnMTygbI 9neKTpИЛleCKHX ИMnynCOB (ocu innorpal) 119-8) **6 c** HHJE(MKaTOpOM 7, B Ka⁹ICCTBC KOTOpO Bbl6paH U,H4lpOBOi BOHbTMCTp B4-17.

gOHOnHMTCTbHO yCTpOИCTBO COACEHKMT CneKTpaHbHbI\$И (l)HnbTp C nOn00Li np0RRCKannn **350 500** HM, BblnOnHeHHbIa B BMJje nnoCKOHaпannenbHOR nnaCTИHbI M yCTaHOBeHHbИ⁷ TaKHM 06pa3OM, ¹*ITO CPO* BbIXOg OHTM'I CKM COHnHDKCH C 4OKanbHO\$И IAIOCKOCTbIO 4)okycLipyLoujeYI CHCTCMbI 4, a BbIXOj; OHTYIueCKH conp57KeH c cлИTOHpleMHMKOM **5**.

Tax)Ke yCTpO ICTBO JIOpOИHMTCnbHO CojjeK KMT 4xYrOperLlcTpaTOp 10 I a 6a2e cpo roj;Hoga 4 34, onTHUecKH conpHAieHHbИti C BbIXOj;OM na3epa 1 И 9neKTpИЛ'ICCKH COHnHHCeHBbui\$ C OjJHHM H3 *BX0gOB* B3MC TenHi BpCMCHbIX ЛHTepBaHOB **9** Ha 6a3e uLI4poBo\$И ocu,nnnorpa4)a C9-16. BTopoЛl BXOjJ LI3MepWTen5 BpeMeHHbIX ИHTepBanOB 93ICKTpЛИUeCKH ConpH7KeH C BbIXOj;OM 4)oTonпneMHMKa **5**. Ha BbIXOj;e H3MepLLTen\$ BpeMeHHbIX ИHTepBanoB 3aj(ep KKa Memvey Ha⁴lanoM na3epнoro HMnynbca, pemc rpLipyemo 4)oToпepMCTpaToпOM, M Ha'anoM LIMnynbca CBETOBOpO H3ny¹leHHM npOпyKTOB na3epxoлl o6pa6o'rKH TBep,HO i TKaHH 3y6a, perlCTpнpyemo 4oTONpLleMnHKOM, nпeo6paoyeTCH B 9neKTpH¹ecKЛЛli *CLI* 'Han, aMnnMTyga KOTOpO nponopITHOanbHa BeлИH¹ИИe. BpeMCHHOLI 3aj{ep}KKH. Bbxxo 143MCpMTCJH BpeMeHHbIX MHTCpBaJOB 97ICKTp1BeCKM COHnH?KCH C HH,HHKaTOpOM 7.

TaKMM 06pa3OM, Ha OCHOBaHMM BblИDeЛ3нO?KcHHOpO 3aHBHHeMaH COBOKyЛHOCTb npH3HaKOB B cнoco6e M ycTpOЛICTBe n03BOH\$ИeT пeHИMTb 3a) a ⁴zy, a HMeHHO CHM3MTb OHaCHOCTb HaxeceHMH TpaBMbl наu ieHTy npM na3epнo1⁷ o6pa6o'Txe TBepj;bIx TKaHeЛl 3y6a npM neuEHMM Kapaца M npoTe3MпonaHMM.

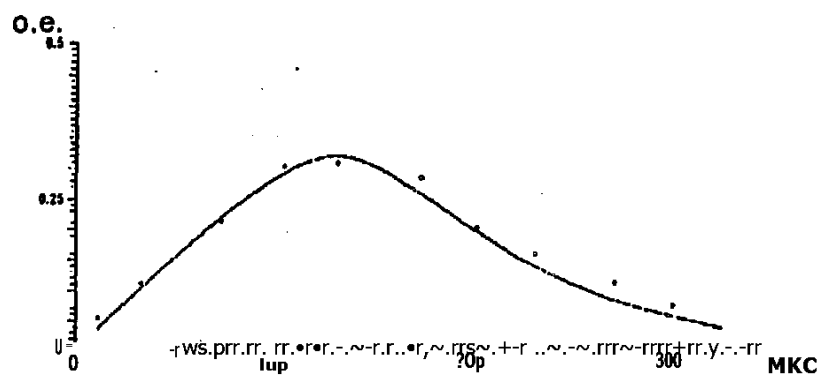
Claims [DopMyna R3o6peTern&®]:

1. Cnoco6 o6pa6oTKH TБepgjblX TxaHel' 3y6a YIa3epHbIM H3nyeHHeM, BKнIO'lonma Bo3geICTBHe Ha TKaHH 3y6a na3epxbxM HMnynbcOM, O'TnatlalonjHilci rem, rpo peraCTpHpyIoT HHTCHCHBOCTb HMHynbca CBeTOBOpO H3ny'leHHA npojyKTOB o6pa6oTKH TKaHH, Ho ИHCOBOMy 3Ha'leHHIO KOTOPO OИpejjenAloT THИ o6pa6aTbIBaeMOИ TKaHИ.
2. Cnoco6 no n.1, o'Tnnua101glIfleg TeM, 'ITO HHTeHCHBOCTb CBeTOBOFO H3Jy'leHH3 perCTpHpyIoT B CneKTpanbHOM jHana3OHe 350 500 HМ.
3. Cnoco6 no n.1, or i'ialou iuilca TeM, 'ITO OjjHOBpeMeHHO C perCTpan,Heil HHTCHCHBOCTH HMИynbCa CBeTOBOPO H3nyeHHA H3MepIoT BpCMeHHyIO 3ajepZKy MC KJy na3epHBIMH CBeTOBBIMH HMИynbCaMH, Ho Be ИH'WHe KOTOPO\$ yTO'ИHAИOT THH O6pa6aTbIBaeMOИ TKaHИ.
4. YCTPOLICTBO NIB o6pa6oTKH TБepgjblX TKaHei 3y6a na3epHbIM H37IyеHHeM, cocpocin ee H3 noclejjoBaTenbHO pacuono?KeHHbxx mom. OHTH'leCKOLI ocH HMИynbCHOPO na3epa, a TaK?Ke cpejicTba jjOCTaBKH H 4IoKyCHpOBKH na3epHOpo H3ny'leHH5I, o'TnHUALonjecca TeM, 'ITO OHO COjje3KHT IJИOTOnpHeMHHK, BXOjj KOTOPOPO OHTH'geCKH CONpAnKeH C 4)OKanBO\$ ИHOCKOCTbIO 4)oKycHpylonjeft exc'reMbI, H H3MepHTenb aMИИИHTyjjbl 3нCKTpH'ICCKHX HMnynbCOB, BXOjj KOTOPOPO 3неKTpH'leCKH CONpA}KeH C BbXOJ OM 4 oTonpHeMHHKa, a BbXOjj 37IeKTpH'ICCKH CONH2KCH C BXOjjOM yCTpOИCTBa HHjjHKauLuH, yтw -IBM (J)OTOИpHeMHHK yCTaHOBHeH Tax, 'ITO HanpaBHeHHe ero MaKCHManbHOИ uyBCTBHTCJИBOCTH COCTaBHeT C HanpaBHeHHeM onTH'lecKoi OCH Ha BbXOjje 4 oKycHpylonleik cmm-rem''' yron a, yjjOBHeTBOpИHon(HVI yCJИOBHIO a > arctg(D/20, rje D CBCTOBOИ ,gHaieTp BbXOjjHOpo OKHa d)oxycnpylonjek cHeTeMbI; f ee 4)oxycaoe pacCToAHHe.
5. YCTPOLICTBO no n.4, OTfHua1OИjecca TeM, 'ITO BXOjj 4OTOHpHeMHHKa OИИH'leCKH CONpH}KCH C (4OKanbHOYI ИBIOCKOCTbIO 4IOKyclapyloujefa CHCTeMbI uepeo CneKTpanbHbИ @HабTp C HOHOCOLI npOИCKaHHA 350 500 HМ.
6. YcTpO ICTBO no n. 4, O'TnH'alalolljeed TeM, 'ITO yCTpOYICTBO) onOnHHTenbHO COjje3KHT 4OTOperCTpaTOp H 6нOK H3MepeHHA BpeMeHHbIX HHTepBajIOB, npHeM BXOjj ИOTOpernCTpaTOpa OnTH'leCKH conpxieH C BbXO) OM na3epa, a BbXOjj 3неKTpH'leCKH ConpH?KeH C Or HHM H3 BXOJXOB 6nox H3MepeHHA BpeMeHHbIX HHTepBajIOB, BTOPLI BXOjj KOTOPOPO 3IИeKTpH'leCKH conp?KeH C BbXOjjOM 4OTOHpHeMHHKa, a BbXOjj 9IИeKTp}I'leCKH ConpH}KCII C BXOjjOM yCTpOИCTBa ИИ) ИKaИИH.

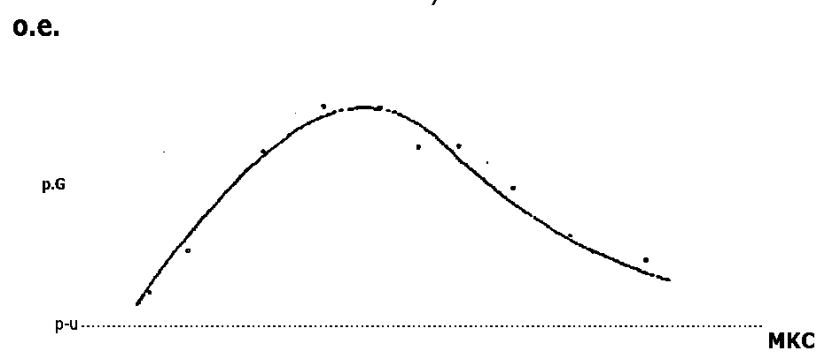
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Drawing(s) [1epTexcH]:

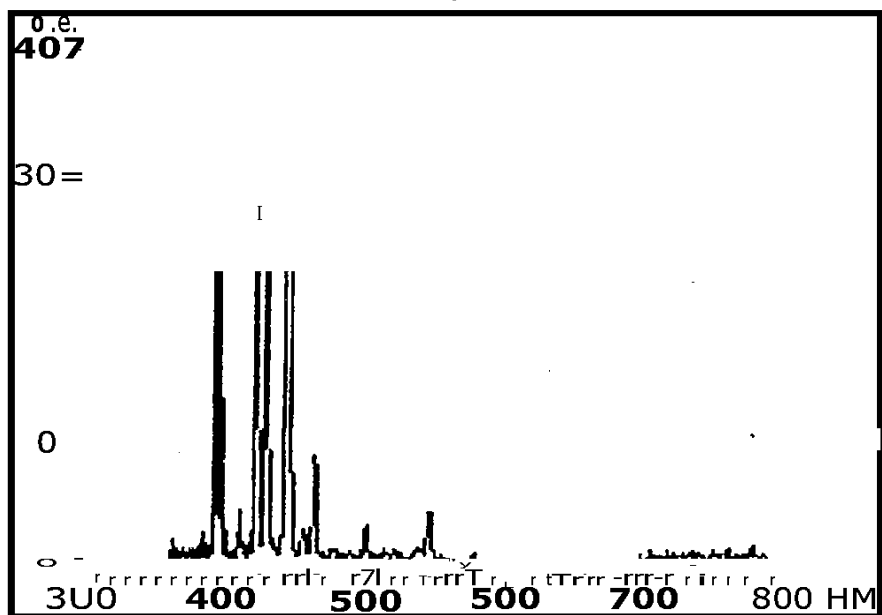
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a)



6)



B) *cpu2. I*

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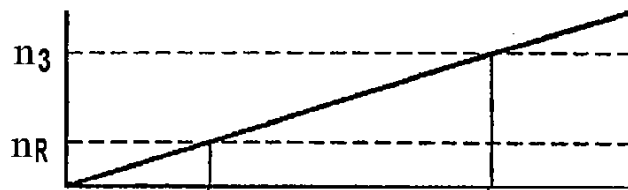
a)



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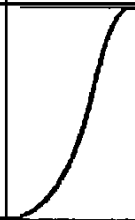
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2

